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The 1988 Return of Even Year Pink Salmon Stocks to the Johnstone Strait Study Area

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ABSTRACT

A.P. Stefanson, L. Hop Wo and A.P. Gould. 1991. The 1988 return of even year pink salmon stocks to the Johnstone Strait Study Area. Can. Manuscr. Rep. Fish. Aquat. Sci. 2112: 48p.

The 1988 fishing plans for the Johnstone Strait Study Area were developed jointly by the Department of Fisheries and Oceans (D.F.O.) and the Pacific Salmon Commission (P.S.C.). The fishing season for commercial gillnets and seines opened August 3, and closed September 6. The number of days fishing in statistical Areas 12 and 13 totalled 16.0 gillnet and 11.0 seine days, the least since the 1978 cycle.

A stock assessment program was conducted jointly by D.F.O. and P.S.C. using a gillnet test vessel. Test catches combined with scale sampling determined the relative strength and racial stock composition of passing sockeye stocks.

Pink salmon commercial catches and escapements in the Johnstone Strait Study Area were 989,200 and 1.83 million respectively. The total returning pink stock was 2,819,700 million which included a significant hatchery contribution. The 1988 return of 2.8 million pink salmon was produced from a 1986 brood escapement of 1.4 million resulting in a 2.1 to 1 production ratio.

The total commercial catch of passing Fraser and returning Study Area sockeye was 150,613. This was less than anticipated due to a lower than expected diversion rate of 25%.

The Study Area sockeye escapement (excluding the Fraser River component) was estimated at 147,600 and is one of the lowest escapements on record. The total Study Area sockeye stock for 1988 was estimated at 151,700, resulting in an exploitation rate of 2.6%.

Key words: pink salmon, sockeye salmon, Johnstone Strait Study Area, fishery, escapement.

RÉSUMÉ

A.P. Stefanson, L. Hop Wo and A.P. Gould. 1991. The 1988 return of even year pink salmon stocks to the Johnstone Strait Study Area. Can. Manuscr. Rep. Fish. Aquat. Sci. 2112: 48p.

Les plans de pêche de 1988 pour l'aire d'étude du détroit de Johnstone ont été élaborés conjointement par le ministère des Pêches et des Océans (D.F.O., en anglais) et la Pacific Salmon Commission (P.S.C.). La saison de pêche commerciale au filet maillant et à la senne a débuté le 3 août et s'est terminés le 6 septembre. Les nombres de jours de pêche dans les zones statistiques 12 et 13 ont totalisé 16,0 et 11,0 jours pour les pêche au filet maillant et à la senne, respectivement, nombres de jours de pêche les plus faibles depuis 1978.

Un programme d'évaluation des stocks utilisant un bateau prévu à cette fin équipé d'un filet maillant a été mené conjointement par Pêches et Océans et la P.S.C. Les prises expérimentales et l'échantillonnage des écailles ont permis de déterminer les effectifs relatifs et la composition raciale des stocks de saumon rouge de passage.

Les prises commerciales et les échappées de saumon rose dans l'aire d'étude du détroit de Johnstone atteignaient 989 200 et 1,83 millions de poissons, respectivement. La remonte totale du stock de saumon rose se chiffrait à 2 819 700 poissons, nombre comprenant un pourcentage important de saumons produits en écloserie. Cette remonte de 2,8 millions de saumons roses en 1988 est le fruit des 1,4 millions d'adultes de l'échappée de 1986, ce qui représente un ratio de production de 2,1 pour 1.

Les prises commerciales de saumon rouge en montaison dans l'aire d'étude et de passage dans le Fraser ont totalisé 150 613 poissons. Elles ont été inférieures à ce qu'on s'attendait en raison d'un taux de détournement de 25 %, plus faible prévu.

L'échappée de saumon rouge dans l'aire d'étude (excluant les saumons du Fraser) a été estimée à 147 600 et est l'une des plus faibles jamais enregistrées. Le stock total de saumon rouge dans l'aire d'étude en 1988 a été estimé à 151 700 poissons, ce qui donne un taux d'exploitation de 2,6 %.

Mots-clés : saumon rose, saumon rouge, l'aire d'étude du détroit de Johnstone, pêche, échappée.

1.0 INTRODUCTION

Since 1962 the Department of Fisheries and Oceans (D.F.O.) has biannually published status reports on even year pink and sockeye salmon. This report is a continuation of a series which centres on salmon stocks originating from the Johnstone-Georgia Strait Study Area and on those Fraser River sockeye returning via the inside migration route.

This report, while providing a general overview of the weekly commercial fisheries activities during the 1988 fishing season also includes a comprehensive documentation of the management strategies used in the Johnstone Strait Study Area (Statistical Areas 11-16) commercial fisheries. In addition, management decision rationale, interpretation and results relating to sockeye and pink catches are presented. Escapements of Study Area pink and sockeye are included.

The 1988 sockeye season was the third consecutive year that the Fraser Panel had responsibility for in-season management of Fraser River sockeye and the second year for Fraser pink salmon within the Fraser River Panel Area (Fig. 1). Fishing times and area plans for non-Panel waters, which are the responsibility of D.F.O., were developed in conjunction with Fraser River sockeye objectives. The 1988 combined efforts and results of the fisheries in the Johnstone Strait Study Area are precisely documented in this report.

2.0 AREA AND FISHERY DESCRIPTION

2.1 Area

The Johnstone Strait-Strait of Georgia Study Area (Fig.2), includes the largest interception fishery in British Columbia and consists of Johnstone Strait and waters of the Strait of Georgia north of the Fraser River Panel Area. The Study Area is divided into broad Statistical Areas (Fig. 1) which in turn are further subdivided into sub-areas or management units detailed by specific boundaries (Fig. 3). All fishing areas remain "closed unless opened" by in-season regulation.

Within the Study Area there are approximately 60 streams which contribute to the pink stock. All even year pink stocks spawn within the Study Area north of the Mid-Vancouver Island and Loughborough to Bute Inlet sub-areas. The migration of Study Area

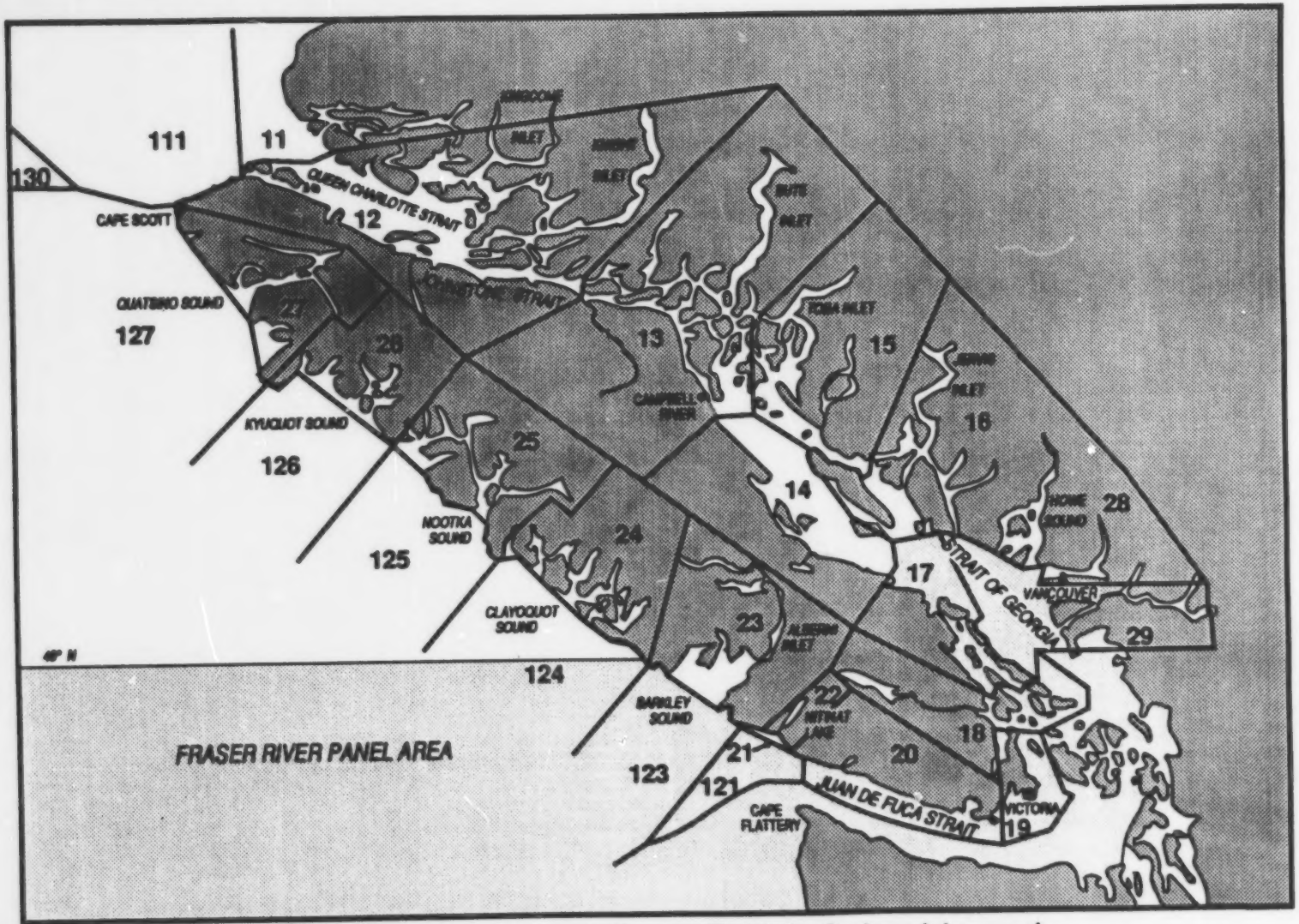

Figure 1. Statistical area map of southern British Columbia and adjacent waters.

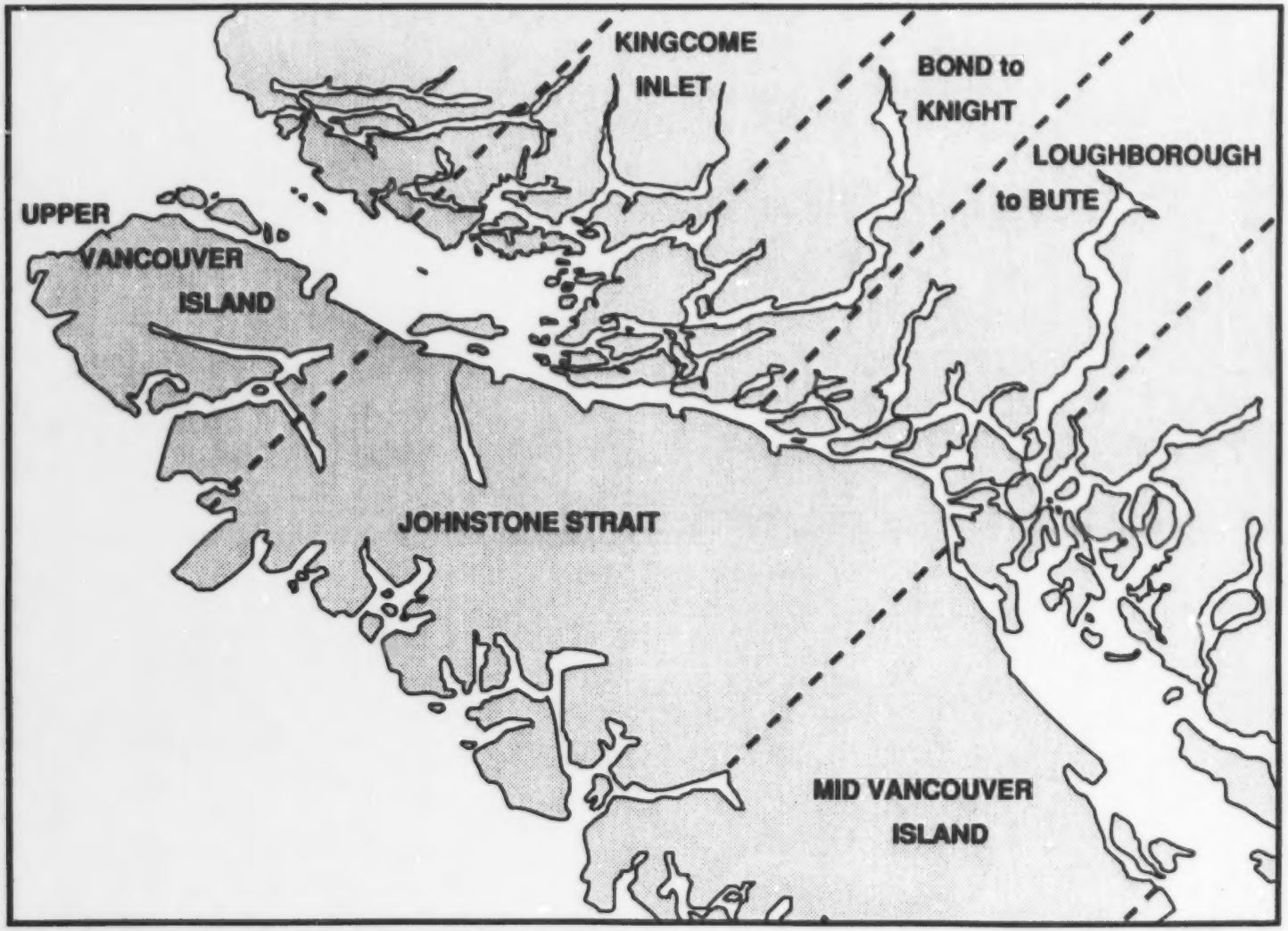

Figure 2. The Johnstone Strait Study Area showing major even year pink stock groups.

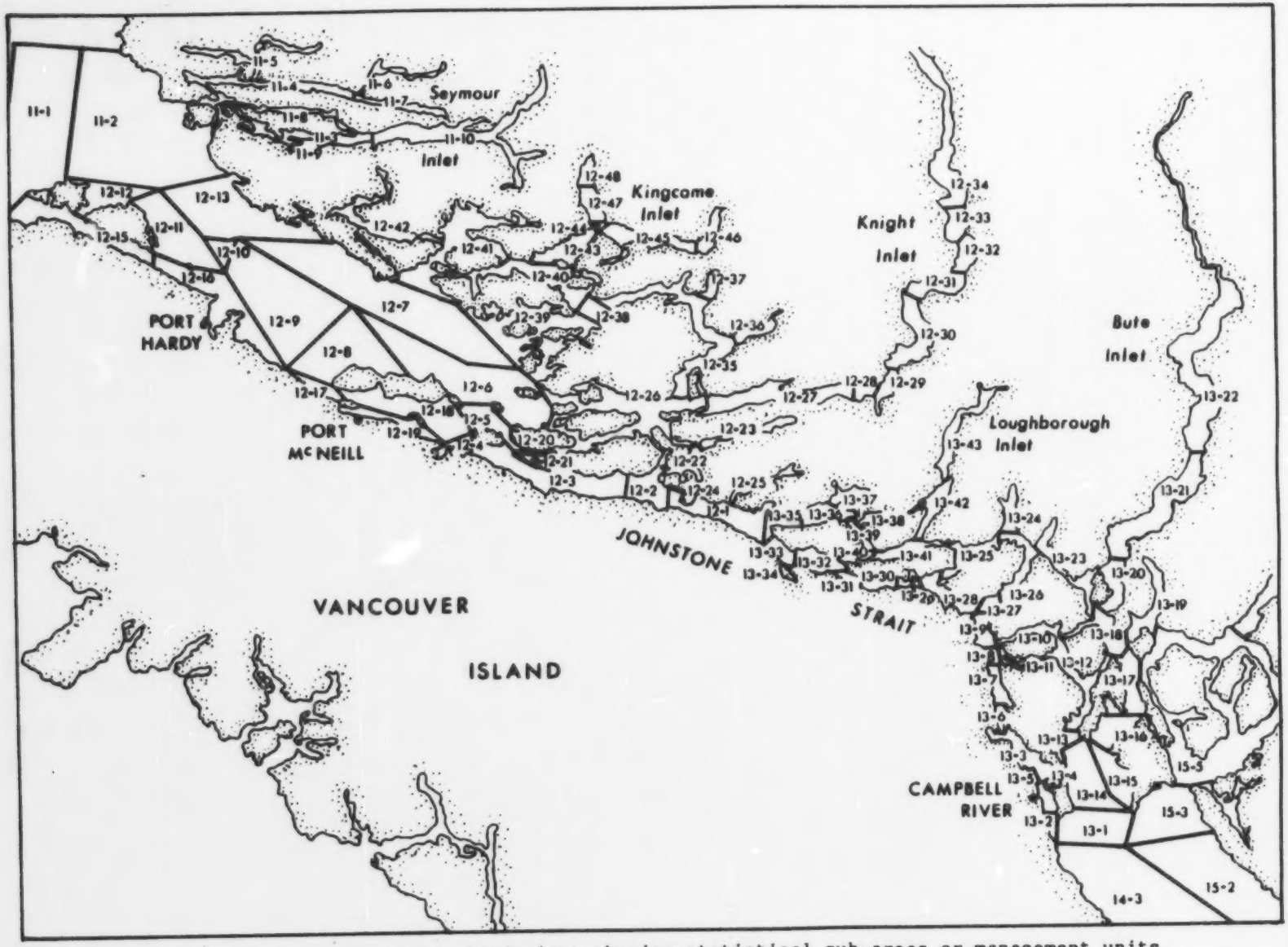

Fig. 3. The Johnstone Strait Study Area showing statistical sub-areas or management units.

pink stocks through Johnstone Strait generally extends from the end of July to mid August and is entirely via the northern approach.

For sockeye production, the Nimpkish River is the most significant of the five rivers that support sockeye populations within the Study Area. These stocks migrate via the northern route and usually enter the area in mid-May and continue through mid-July.

2.2 Fishery

The Johnstone Strait interception fishery in Area 12 and 13 is managed for Fraser River sockeye and pink stocks while usually harvesting an incidental catch of Study Area pinks and sockeye. An overlapping migration timing and a similar migration route to those passing Fraser sockeye stocks makes Study Area pink stocks highly vulnerable during years of abundant Fraser sockeye. Terminal harvesting of pink salmon in Area 12 mainland inlets may also occur, providing specific surpluses are identified. In addition to the Johnstone Strait fishery, a minimal number of pinks are harvested incidentally in Sabine Channel (Area 16). This fishery targets upon surplus Fraser sockeye prior to their entering the Fraser River.

For the protection of Study Area pink and sockeye stocks and the reduction of incidental chinook catches, the fishing plans are sometimes modified. However, in Johnstone Strait the exploitation of Fraser River sockeye is the primary factor in the development of the management plans for the Study Area.

The principal element in assessing Fraser River stock abundance in Johnstone Strait is the rate at which sockeye and pinks migrate via Johnstone Strait and is referred to as diversion.

Diversion of Fraser River sockeye through Johnstone Strait may vary considerably each year, as presented below.

Year	Cycle year diversion rates on the Fraser sockeye returns
1976	21%
1977	18%
1978	57%
1979	27%
1980	70%
1981	67%
1982	22%
1983	80%
1984	31%
1985	33%
1986	22%
1987	36%
1988	15%

3.0 1988 MANAGEMENT APPROACH

3.1 Development of 1988 Management Plans

This section presents the general management approach and procedures followed by the South Coast Division of the D.F.O. in developing pre-season fishing plans and conducting in-season management.

The 1988 sockeye fishing season was the fourth year of management under the Pacific Salmon Treaty. For the third consecutive year the Fraser Panel had sole responsibility for the management of Fraser River sockeye within the Fraser Panel Area. For those waters outside the Panel Area, particularly Johnstone Strait and Sabine Channel, fishing times and area plans which are the responsibility of D.F.O. were developed in conjunction with the Fraser River Panel to achieve the Fraser River sockeye objectives.

The final fishing plans and stock expectations are published in a D.F.O. information bulletin titled "Salmon Expectations". These pre-season plans serve as a guideline only and may require in-season revision.

3.2 Management Objectives and Considerations

The major objectives affecting the Johnstone Strait Study Area fishing plans are Fraser sockeye abundance, Study Area pink and Study Area sockeye abundance and their required escapement. In addition, diversion rate, migration timing, international and domestic sharing and reduced incidental catches of chinook are considered.

These objectives were to be accomplished in 1988 by the regulation of in-season fishing times and areas in accordance with the developing salmon runs as they migrate into the Study Area and through the Johnstone Strait.

In total, the 1988 proposed fishing plan included 7 fishing days over a 5 week period.

3.2.1 Study Area Pinks

In order to protect anticipated poor Study Area pink stocks returning to Kingcome-Wakeman and Bond Sound systems, conservation measures were to be provided during the Fraser sockeye fishery. These measures included delayed openings and area closures (Appendix 1). In the event of a harvestable surplus return to the Kakweiken and Glendale rivers, it was proposed to crop the surplus terminally in upper Area 12.

3.2.2 Study Area Sockeye

Conservation measures were required to protect the Study Area sockeye which were expected to have poor returns in 1988. In particular, the dominant Nimpkish stock, which generally peaks in the first three weeks of July, was to be protected by a closure until July 27, and by area closures (Area 11 and upper Area 12). It was expected that only small numbers of Study Area sockeye would be caught, primarily in outside troll fisheries prior to this date.

3.2.3 Fraser Sockeye

The primary management focus during the Johnstone Strait summer fishery centres around the harvest of passing Fraser River stocks. The basic Fraser River concerns are biologically related factors combined with catch sharing allocations.

In 1988, the pre-season gross escapement objective for Fraser River sockeye as determined by D.F.O. was 1,540,000 spawners. This goal included 1,000,000 adult and 40,000 jack sockeye for spawning

escapement and 500,000 allocated for the Indian Food Fishery. Provisions under the International Treaty required that the United States receive 39.2 % of the Total Allowable Catch (T.A.C.). Canadian domestic allocations are presented in Section 3.2.5.

Anticipated Fraser River sockeye migration timing is based on environmental factors such as sea surface temperatures and salinity. This information correlated with Gulf of Alaska data results in an estimation of timing. In addition, the 1988 fishing plan recognized that severe conservation concerns existed for the major stock of this cycle - the Chilko River sockeye. Harvestable surpluses had been identified on those stocks arriving prior to and after the early-August peak of the Chilko run. Fishing was proposed on these stocks, chiefly the Stellako, Birkenhead and Weaver Creek sockeye, all of which normally arrive in the fishing areas after the Chilko run. Fishing plans also included a closure of all commercial fisheries during the passage of the early Stuart stocks to allow a high proportion of this stock to reach the spawning grounds.

3.2.4 Chinook

The harvest rate on the lower Georgia Strait chinook stocks was to be reduced by 20% in the Johnstone Strait commercial net fishery. It was expected that due to the anticipated poor sockeye return, fishing time would be limited, thus accomplishing the requirement to reduce the harvest rate by the desired percent. However, additional measures would be necessary in 1989 and 1990 to meet the 20% harvest rate reduction goal. As in past years, specific time and area closures including the "Ribbon Boundary" and the Parsons Bay closure were in effect in order to minimize chinook catches and maximize conservation of pink salmon (see Section 5.1).

3.2.5 Allocation

The estimated pre-season T.A.C. of Fraser sockeye was 1,430,000 which included 791,000 fish for the Canadian fishermen. The remaining U.S. allocation included a payback of 48,000 fish owed by Canada from prior years. The goals for Canadian allocation of Fraser River sockeye in all fisheries, as determined by the Minister of Fisheries were: seines (52.8%); gillnets (38.4%); outside troll (4.8%) and inside troll (4.0%). The inside (Strait of Georgia) troll fishery was to be allocated additional late-run sockeye if escapements to the Strait of Georgia were in excess of spawning requirements.

4.0 1988 PRE-SEASON EXPECTATIONS

4.1 Study Area Pinks

The 1988 expected return of Study Area pink salmon, based on the brood year escapement of 1,380,700 was projected to be approximately 3.0 million, with the majority expected to return to the Bond to Knight Inlet area. As the brood escapement equalled the required escapement of 1,366,000, a total allowable catch of 1.0 million was anticipated. This potential surplus would be harvested in Area 12 Mainland Inlet fisheries (lower Knight and Tribune Channels) and as an incidental catch in the Johnstone Strait sockeye fishery.

4.2 Study Area Sockeye

Study Area sockeye escapements for brood years 1983 and 1984 were minimal. The dominant Nimpkish-Woss run had brood escapements of 70,000 and 50,000 respectively. It was expected that the total 1988 escapement would fall far short of the target escapement of 305,000. An estimate of approximately 158,000 sockeye would return to the Nimpkish system in 1988. This estimate was based upon brood escapements combined with results of juvenile echo sounding on Nimpkish Lake. A harvest of Study Area sockeye was not anticipated for the 1988 season other than a minor Nimpkish Indian Food fishery in June.

4.3 Fraser Sockeye

The 1988 Fraser River sockeye run as forecasted by D.F.O. was expected to total 2,900,000 million. A net required escapement of 1.0 million plus the in-river Indian food fisheries would leave approximately 1.3 million available for harvesting. Under Treaty requirements, the U.S.A. harvest allocation was to be 510,000 sockeye including a 49,000 fish payback of prior years' catch shortfall. The Canadian commercial catch was expected to be approximately 790,000 sockeye. This total catch of 1.3 million would be the lowest since 1964. The harvest rate, or percentage of the run caught in the commercial fisheries was expected to be the lowest of all years on record. The international allocations were expected to be adjusted in accordance with terms and provisions of the Pacific Salmon Treaty during the season as the actual run strength was identified.

5.0 PRE-SEASON FISHING PLANS

5.1 Areas 11, 12, 13 and 16

The Johnstone Strait-Strait of Georgia pre-season fishing plans for 1988 are summarized and detailed following. Briefly, Areas 12 and 13 were scheduled to open for nets the week of July 24 for one weeks fishing, closed for one week then open for three weeks to close on August 27th. Gillnets only in Area 11 and nets in Area 16 were scheduled to open on August 7th for three consecutive weeks fishing closing also on August 27th.

The weekly opening for gillnets in Area 11 was to be for 2.5 days per week for a seasonal total of 7.5 days. Areas 12 and 13 were to be 1.5-2.5 days/week for gillnets and 1.0-2.0 days/week for seines, giving a season total of 9.0 gillnet days and 7.0 seine days. Area 16 was allocated 2.0 days/week for gillnets and seines for a seasonal total of 6.0 days. Catches in this fishery were to be dependent on the diversion rate and the numbers of Fraser River stocks escaping from the Johnstone Strait fishery.

Proposed fishing pattern for the Johnstone Strait Study Area (Statistical Areas 11, 12, 13 and 16), 1988.

WEEK OF	STARTING TIME	DAYS	AREAS OPEN
AREA 11			
To Aug 6	--	0	CLOSED
Aug 7 to Aug 27 (Three Weeks)	1800 Sunday	2.5 GN	Sub-area 11-1 and portion from Bright Island to Pine Island to the Apex of the Cape Caution line.
Aug 28	--	--	CLOSED FOR THE BALANCE
AREA 12			
To July 23	--	--	CLOSED
Jul 24 to Jul 30 (One Week)	1800 Sunday	1.0 SN 1.5 GN	Sub-areas 12-1, 12-3, 13-4 (that portion of Area 12 lying south east of a line from Lewis

WEEK OF	STARTING TIME	DAYS	AREAS OPEN
AREA 12-cont.			
			Point on Vancouver Island to the most easterly point on Hanson Island). Ribbon Boundary will be in effect south east of a boundary sign at Big Bay, Hanson Island. Adams River box boundary in effect (12-2). Mainland Inlets closed.
Jul 31 - Aug 6	--	--	CLOSED
Aug 7 - Aug 20 (Two Weeks)	1800	2.0 SN 2.5 GN	Sub-areas 12-1, 12-3, 12-4, a portion of 12-5 inside a line from Donegal Head on Malcolm Island to a white triangle fishing boundary sign on Spout Island to the most northerly point on Hanson Island and a line from the most westerly point on Hanson Island to Donegal Head, 12-8, 12-9, 12-10, 12-11 and 12-12 easterly of a line from Greeting Point on Nigel Island to Cape James on Hope Island. The Ribbon Boundary will be in effect south east of Big Bay, Hanson Island. Adam River box boundary in effect (12-2). Test fishing for Mainland pink abundance will commence one week prior to proposed August 7th fishery. If a surplus is identified, sub-areas 12-27 (Lower Knight) and 12-35 (Tribune Channel) will open to net fishing. A portion of Sub-area 12-29 will be open for gillnets only with a maximum mesh restriction. Fishing is proposed to commence 1800 hours, August 7th to 1800 hours

WEEK OF	STARTING TIME	DAYS	AREAS OPEN
AREA 12-cont.			
			August 8th for a 24 hour period. Further fishing in Mainland Inlets will depend on stock strength and fleet size. Boundaries may be adjusted to ensure minimal chinook salmon catch.
Aug 21 - Aug 27 (One Week)	1800 Sunday	2.0 SN 2.5 GN	Sub-areas 12-1, 12-2, 12-3, 12-4, 13-5, 12-6, 12-8, 12-9, 12-10, 12-11, 12-12, and a portion of 12-18 easterly of a boundary sign from Lewis Point to Donegal Head. The Ribbon Boundary will be in effect south of Cracroft Point.
Aug 28 - Sept 10 (Two Weeks)	--	--	CLOSED
Sept 11 - Sept 17	1800 Sunday	1.0 SN 1.5 GN	Chum assessment fishery: Sub-areas 12-1, 12-2, 12-3, 12-4, 12-5, 12-6, 12-7, 12-8, 12-9, 12-10, 12-11, 12-12, 12-13, 12-18, 12-21 and 12-24.
Sept 18	--	--	Further fishing dependent on strength of chum return.
AREA 13			
To July 23 (One Week)	--	--	CLOSED
July 24 - Jul 30 (One Week)	--	1.0 SN 1.5 GN	Sub-areas 13-7, 13-8, 13-9, 13-28, 13-29, 13-30, 13-31 and 13-31. The Ribbon Boundary will be in effect.
Jul 31 - Aug 6 (One Weeks)	--	--	CLOSED

WEEK OF	STARTING TIME	DAYS	AREAS OPEN
AREA 13-cont.			
Aug 7 - Aug 27 (Three Weeks)	1800	2.0 SN	Sub-areas 13-7, 13-8, 13-9, 13-28, 13-29, 13-30, 13-31 and 13-32. The Ribbon Boundary will be in effect.
Aug 28 - Sept 10 (Two Weeks)	--	--	CLOSED
Sept 11 - Sept 17 (One Week)	1800 Sunday	1.0 SN 1.5 GN	Chum assessment fishery: Sub-areas 13-7, 13-8, 13-9, 13-10, 13-27, 13-28, 13-29, 13-30, 13-31, 13-32, 13-35 and 13-40. The Ribbon Boundary will not be in effect this week.
Sept 18	--	--	Further fishing dependent on strength of chum return.
AREA 16			
To Aug 6	--	--	CLOSED
Aug 7 - Aug 27 (Three Weeks)	1800 Sunday	2.0 SN 2.0 GN	Sub-area 16-21 easterly of a line from Favada Point to Fegan Islets.
Aug 28	--	--	CLOSED FOR THE BALANCE.

6.0 THE 1988 FISHERY

6.1 Weekly Fishery Summary

Appendix 1 summarizes in-season management actions and details the rationale for modifications from the pre-season plans. The following is a detailed in-season weekly account of the 1988 fishery:

July 24 - July 30 (week 7/5)

The start of the Johnstone Strait commercial fishery for this season commenced as scheduled on Sunday, July 24 at 1800 hours for nets in both Areas 12 and 13. Areas 11 and 16 remained closed. Gillnets fished for 1.5 days and seines for 1.0 days. While the upper portion of Area 12 was closed sub-areas 12-1, 12-3 and a portion of 12-4 were open for fishing. Both the "Ribbon Boundary" and the Adams River "Box Boundary" (12-2) were in effect. Fishing in Area 13 was permitted in sub-areas 13-7 to 9 and 13-28 to 31 inclusive. The "Ribbon Boundary" was in effect.

As there were no extensions this week, the fishery closed for seines at 1800 hours July 25 and for gillnets at 0700 hours on July 26. Limited effort at the beginning of the fishery declined further as poor catches persisted throughout the opening. The light catches this week suggested the possibility that the "inside" diversion might have been less than the norm of between 25-30 %. The Pacific Salmon Commission speculated that the Chilko stock might be far below the pre-season expectation.

The joint D.F.O. and Pacific Salmon Commission (P.S.C.) sockeye gillnet test fishing program in lower Queen Charlotte Strait (Area 12) commenced on July 19th.

July 31 - August 6 (week 8/1) CLOSED

August 7-13 (week 8/2)

The Johnstone Strait - Gulf Commercial Fishery for this week, commenced at 1800 hours on Monday August 8th. Seines and gillnets fished in Areas 12, 13 and 16 and gillnets only in Area 11. Seines opened for 1 day, gillnets in Areas 11, 12, 13 for 1.5 days and in Area 16 for 1.0 day. The Area 12 Mainland Inlets opened on Tuesday, August 9th at 1800 for 2.0 days and included both net and troll gear. Fishing in Area 11 took place in sub-areas 11-1 and in

part of sub-area 11-2. The northern portion of Area 12, Johnstone Strait proper and Mainland Inlet sub-areas 12-35, 12-39, 12-40, 12-41 and 12-43 were open. The Adam River "Box Boundary" and the "Ribbon Boundary" were also in effect. Those portions of Area 13 open this week included sub-areas 13-7 to 9 and 13-28 to 32. The "Ribbon Boundary" in Area 13 was also in effect. Based upon limited catches and low effort during the first 24 hours in Johnstone Strait and Sabine Channel, a 24 hour extension was announced for all inside gear.

The P.S.C. update this week based upon Area 20 gillnet and Fraser River test vessels indicated that the early Stuart sockeye stock was larger this year than previously observed on this cycle. The Chilko stock was upgraded slightly but appeared to be still well below pre-season expectations.

August 14-20 (week 8/3)

For the week of August 14 - August 20th the Johnstone Strait - Gulf fishery opened on Sunday the 14th. Fishing commenced at 1800 hours in Areas 11, 12, 13 and 16. Seines opened for 48 hours in Areas 12, 13 and 16 and gillnets for 61 hours in Areas 11, 12, and 13 and for 48 hours in Area 16. Areas open this week included 11, 12, 13 and 16 and in those sub-areas similar to those designated for the week previous. The Adam River "Box Boundary" was in effect in sub-area 12-2 as was the "Ribbon Boundary" in both Areas 12 and 13. The Area 12 Mainland Inlets remained closed this week.

Initial effort by both gear types increased substantially over the past week. Due to poor fishing, effort rapidly declined as vessels left the district for San Juan (Area 20). The catch of both sockeye and pink salmon this week was considered poor. There were no extensions in the district this week.

A racial composition breakdown by the P.S.C. was not available this week.

Gillnet test fishing in lower Queen Charlotte Strait ended on Friday, August 19.

August 21-27 (week 8/4)

The Johnstone Strait-Gulf fishery commenced on Sunday, August 21 at 1800 hours for 24 hours in Areas 12 and 13 for seines only. As the gillnet catch allocation had been met, Area 11 was closed until further notice and also Area 16 due to light expected sockeye catches and a high incidental catch of juvenile chinook during the previous week.

The Area 12 Mainland Inlets remained closed this week. Fishing in Area 12 took place in sub-areas 12-1 to 12-6, 12-8 to 12-12 and in a portion of 12-18. In Area 13, seines operated in sub-areas 13-7 to 13-9 and in 13-28 to 13-32 inclusive. The "Ribbon Boundary" was in effect in both areas.

Seine effort this week was considered moderate and fishing was generally poor throughout Johnstone Strait. The light catches this week were considered to represent the end of the Study Area pink migration in the Johnstone Strait and of those sockeye destined for the Fraser River. As there was not a seine extension this week the fishery closed on schedule at 1800 hours on Monday, August 22.

The Fraser River sockeye run size remained at 3.4 million. The Canadian catch status by allocation and gear to date had the seine catch short by approximately 250,000 and the gillnets slightly in excess of their allocation and both the outside and inside troll targets met.

It appeared at this time that further sockeye fishing in Johnstone Strait would be unlikely.

6.2 Season Catch Summary

Table 1 summarizes for pink and sockeye respectively, the total season catches by gear and area. Weekly catches by gear for the Johnstone Strait as a whole are shown in Table 2. Weekly catches by gear for individual Statistical Areas are detailed in Table 3 and Table 4 for pink and sockeye. The total catch by all gear of pink salmon in Johnstone Strait in 1988 was 989,193. The total catch of sockeye by all gear in the Johnstone Strait Study Area in 1988 was 150,613 and were primarily those stocks destined for the Fraser River.

6.2.1 Catch by Area

As in past years the majority of the 1988 Johnstone Strait pink catch (79.1%) came from Area 12, however this year the margin was 5% greater as compared to the past 5 brood cycles. Area 13 contributed (6.7%) and Area 11 (14.2%). The catch distribution for sockeye salmon for Areas 11, 12, and 13 was 7.2%, 64.5%, and 28.3% respectively. The Area 13 sockeye contribution was 4.4% higher than the previous 5 even year average (see below, data calculated from Tables 1 and 2).

Table 1. Pink and Sockeye salmon catch by gear and area in the Johnstone Strait Study Area, 1988.

YEAR	GILLNET	SEINE	TROLL	TOTAL
1988 Pink				
Area 11	3,022	0	136,799	139,821
Area 12	14,297	751,328	15,784	781,409
Area 13	792	56,342	8,887	66,021
Area 14	0	0	1,696	1,696
Area 15	0	0	39	39
Area 16	19	173	15	207
Total	18,130	807,843	163,220	989,193
Percent by gear	(1.8)	(81.7)	(16.5)	(100.0)
1988 Sockeye				
Area 11	5,101	0	5,059	10,160
Area 12	34,763	56,761	129	91,653
Area 13	3,570	34,930	1,712	40,212
Area 14	15	0	1,924	1,939
Area 15	0	0	19	19
Area 16	2,477	3,812	341	6,630
Total	45,926	95,503	9,184	150,613
Percent by gear	(30.5)	(63.4)	(6.1)	(100.0)

Source: British Columbia Catch Statistics, DFO.

Table 2. Weekly catch of pink and sockeye by gear in the Johnstone Strait Study Area (combined Areas 11-16), 1988.

WEEK ENDING		Pink				Sockeye			
		GN	SN	TR	Total	GN	SN	TR	Total
To 25-Jun		0	0	0	0	0	0	0	0
02-Jul	7/1	0	0	100	100	0	0	0	0
09-Jul	7/2	0	0	1,057	1,057	82	0	35	117
16-Jul	7/3	0	0	2,984	2,984	0	0	1,847	1,847
23-Jul	7/4	56	0	12,332	12,388	192	0	2,369	2,561
30-Jul	7/5	563	44,432	30,215	75,210	5,637	625	1,498	7,760
06-Aug	8/1	134	0	67,796	67,930	318	0	577	895
13-Aug	8/2	12,796	599,036	33,906	645,738	21,684	50,751	565	73,000
20-Aug	8/3	3,611	137,322	12,889	153,822	17,613	27,334	1,151	46,098
27-Aug	8/4	42	15,807	1,627	17,476	0	16,011	1,062	17,073
03-Sep	9/1	0	0	7	7	0	0	8	8
10-Sep	9/2	0	0	12	12	0	0	11	11
17-Sep	9/3	311	5,703	0	6,014	99	759	16	874
24-Sep	9/4	0	0	98	98	0	0	42	42
After 24-Sep		617	5,543	197	6,357	301	23	3	327
TOTAL		18,130	807,843	163,220	989,193	45,926	95,503	9,184	150,613

Source: British Columbia Catch Statistics, DFO.

Table 3. Weekly catches of pink salmon by gear and area in Johnstone Strait Study Area, 1988.

WEEK ENDING	AREA 11			AREA 12			AREA 13			AREA 14			AREA 15			AREA 16		
	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR
To 25-Jun	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02-Jul 7/1	-	-	14	-	-	-	-	-	78	-	-	8	-	-	-	-	-	-
09-Jul 7/2	-	-	763	-	-	-	-	-	226	-	-	62	-	-	6	-	-	-
16-Jul 7/3	-	-	2,823	-	-	12	-	-	91	-	-	53	-	-	2	-	-	3
23-Jul 7/4	-	-	12,115	56	-	32	-	-	149	-	-	33	-	-	3	-	-	-
30-Jul 7/5	2	-	27,166	469	39,290	1,680	92	5,142	1,334	-	-	31	-	-	1	-	-	3
06-Aug 8/1	-	-	62,066	134	-	1,465	-	-	4,172	-	-	82	-	-	11	-	-	-
13-Aug 8/2	2,067	-	20,670	10,358	564,913	10,357	368	34,033	1,474	-	-	1,397	-	-	4	3	90	4
20-Aug 8/3	953	-	9,613	2,571	130,853	2,220	71	6,386	1,030	-	-	17	-	-	9	16	83	-
27-Aug 8/4	-	-	1,554	-	12,729	18	42	3,078	36	-	-	11	-	-	3	-	-	5
03-Sep 9/1	-	-	3	-	-	-	-	-	2	-	-	2	-	-	-	-	-	-
10-Sep 9/2	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17-Sep 9/3	-	-	-	205	2,895	-	106	2,808	-	-	-	-	-	-	-	-	-	-
24-Sep 9/4	-	-	-	-	-	-	-	-	98	-	-	-	-	-	-	-	-	-
After 24-Sep	-	-	-	504	648	-	113	4,895	197	-	-	-	-	-	-	-	-	-
TOTAL	3,022	0	136,799	14,297	751,328	15,784	792	56,342	8,887	0	0	1,696	0	0	39	19	173	15

Source: British Columbia Catch Statistics, DFO.

Table 4. Weekly catches of sockeye salmon by gear and area in Johnstone Strait Study Area, 1988.

WEEK ENDING	AREA 11			AREA 12			AREA 13			AREA 14			AREA 15			AREA 16		
	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR
To 25-Jun	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02-Jul 7/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
09-Jul 7/2	-	-	34	82	-	1	-	-	-	-	-	-	-	-	-	-	-	-
16-Jul 7/3	-	-	1,843	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-
23-Jul 7/4	-	-	2,155	192	-	2	-	-	5	-	-	207	-	-	-	-	-	-
30-Jul 7/5	50	-	321	4,307	167	61	1,280	458	457	-	-	470	-	-	-	-	-	189
06-Aug 8/1	-	-	157	318	-	6	-	-	41	-	-	360	-	-	13	-	-	-
13-Aug 8/2	2,998	-	518	15,582	26,468	-	1,856	20,829	-	-	-	30	-	-	-	1,248	3,454	17
20-Aug 8/3	2,053	-	4	14,004	20,811	52	327	6,165	1,070	-	-	5	-	-	6	1,229	358	14
27-Aug 8/4	-	-	9	-	8,595	1	-	7,416	122	-	-	817	-	-	-	-	-	113
03-Sep 9/1	-	-	7	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
10-Sep 9/2	-	-	10	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
17-Sep 9/3	-	-	1	66	712	-	33	47	-	-	-	15	-	-	-	-	-	-
24-Sep 9/4	-	-	-	-	-	-	-	-	14	-	-	20	-	-	-	-	-	8
After 24-Sep	-	-	-	212	8	-	74	15	3	15	-	-	-	-	-	-	-	-
TOTAL	5,101	0	5,059	34,763	56,761	129	3,570	34,930	1,712	15	0	1,924	0	0	19	2,477	3,812	341

Source: British Columbia Catch Statistics, DFO.

Comparison of annual percent catch by Statistical Area

Year	PINKS Area 11	PINKS Area 12	PINKS Area 13	SOCKEYE Area 11	SOCKEYE Area 12	SOCKEYE Area 13
1978	5.2	87.4	7.1	4.0	69.1	25.7
1980	6.3	87.2	6.1	1.0	63.1	27.5
1982	4.6	83.9	10.0	2.2	65.2	25.6
1984	5.8	82.5	10.5	1.5	71.0	22.1
1986	12.5	74.0	13.2	8.0	70.1	18.6
1988	14.2	79.1	6.7	7.2	64.5	28.3

Source: British Columbia Catch Statistics, D.F.O.

6.2.2 Catch by Gear

The majority of the 1988 catch of pinks (81.7%) and sockeye (63.4%) was harvested by seines, followed by gillnets (1.8% of pinks and 30.5% of sockeye) and troll (16.5% of pinks and 6.1% of sockeye). The 1988 pink seine component was about 15% higher as compared to the 1986 brood cycle year but comparable to the recent cycle years of 1978 to 1984. The 1988 gillnet pink harvest component was 25% less than 1986 while the troll percent catch was greater by 8.6% than the previous 5 cycle year average. (see below, data calculated from Tables 1 and 2).

Comparison of annual percent catch by gear

Year	PINKS Seine	PINKS Gillnet	PINKS Troll	SOCKEYE Seine	SOCKEYE Gillnet	SOCKEYE Troll
1978	82.1	9.4	8.4	84.4	8.6	7.0
1980	73.4	16.0	10.5	91.1	7.2	1.8
1982	85.2	7.3	7.4	80.3	14.1	5.6
1984	80.8	12.2	7.0	75.8	23.2	1.0
1986	67.1	26.8	6.1	66.1	28.3	5.5
1988	81.7	1.8	16.5	63.4	30.5	6.1

Source: British Columbia Catch Statistics, D.F.O.

6.3 Fishing Effort

Vessel counts at the onset and during commercial fisheries are realized primarily by aerial overflights along with observations from local patrol vessels. In 1988 the overall gear distribution and effort was comparable to that of past years throughout Johnstone Strait. During the 1988 pink and sockeye net fishery, gillnets fished for 6.5 days and seines for 6.0 days in each of

Areas 12 and 13. Weekly gear counts (seine and gillnet) and days fishing are shown for each area in Table 5. Fishing effort data are based on a 13-week period when the fleet was targeting on pink and sockeye salmon. After this period the target species had shifted to chum salmon and so the catches are not considered in this report. The actual fishing time during the 1988 season was the shortest since 1978 and illustrates the progressive decline since that time.

6.4 Stock Timing

6.4.1 Study Area Pinks

Run timing of the major Study Area pink stock groups through Area 12 is shown in Figure 4. Figure 4 and Table 3 illustrate the approximate annual run timing of Study Area pink stocks during the 1978-1988 cycle years, as indicated by the weekly pink total catches in Area 12.

In 1988 peak weekly catch of pinks in Area 12 totalled 146,241 and occurred during the week of August 7-13 (week 8/2). This peak timing is similar to the 1956-1970 cycle, when the average peak catches occurred around August 16. This peak catch is several weeks later compared to the 1978-1988 cycle period. The early peak catches (mean 1972-1984) are generally attributed to the abundance of the early mainland inlet stocks including Kingcome-Wakeman and Kakweiken rivers, while the later peak catches (mean 1956-1970) are attributed largely to the Bond to Knight Inlet stocks (Gould et al., 1988). The latter stocks returned with some strength in 1986, as confirmed by the escapement records.

6.4.2 Fraser River Sockeye

Run timing is indicated by the weekly total sockeye catches in Area 12 where the majority of sockeye are harvested. The year-to-year variation in peak timing catch of sockeye is related to the strong cyclical nature of the dominant Fraser River stocks which influence the annual timing. These stocks were the early summer run Chilko stocks in 1980, 1984 and 1988.

In 1988 the sockeye run was dominated by the conservation need to protect Chilko River returns which are traditionally the most productive stock on the cycle. The actual peak timing occurred during August 7-13 (week 8/2) and August 14-20 (week 8/3) when 25,555 and 32,702 sockeye respectively were harvested in Area 12. The 1988 timing was approximately one week later than anticipated when compared to recent cycle years of early summer run Chilko

Table 5. Weekly gear counts (seine and gillnet) and days fished for Areas 11-13 and 16, 1988.

	AREA 11		AREA 12				AREA 13				AREA 16				TOTAL			
	Vessels #	Days	Vessels		Days Open		Vessels		Days Open		Vessels		Days Open		Vessels		Days Open	
WEEK	GN	GN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN
7/5			63	20	1.5	1.0	12	7	1.5	1.0	closed				75	27	1.0	1.0
8/1	closed		closed				closed				closed				0	0	0.0	0.0
8/2	70	1.5	70	68	2.5	2.0	9	13	2.5	2.0	30	9	1.0	1.0	149	81	2.2	2.0
8/3[a]	59	2.5	257	128	2.5	2.0	14	57	2.5	2.0	70	50	2.0	2.0	330	185	2.5	2.0
8/4[b]				84		1.0		54		1.0	closed				0	138	0.0	1.0
SEASON TOTAL		4.0			6.5	6.0			6.5	6.0			3.0	3.0			5.7[c]	6.0[c]

[a] No more fishing for Fraser River sockeye by gillnets includes Areas 11, 12, 13 and 16.
[b] The Study Area pink and sockeye fishery was officially terminated on week 9/1.
[c] Total season days applies to Area 11 (GN only), Area 12 and Area 13, but not to Area 16.

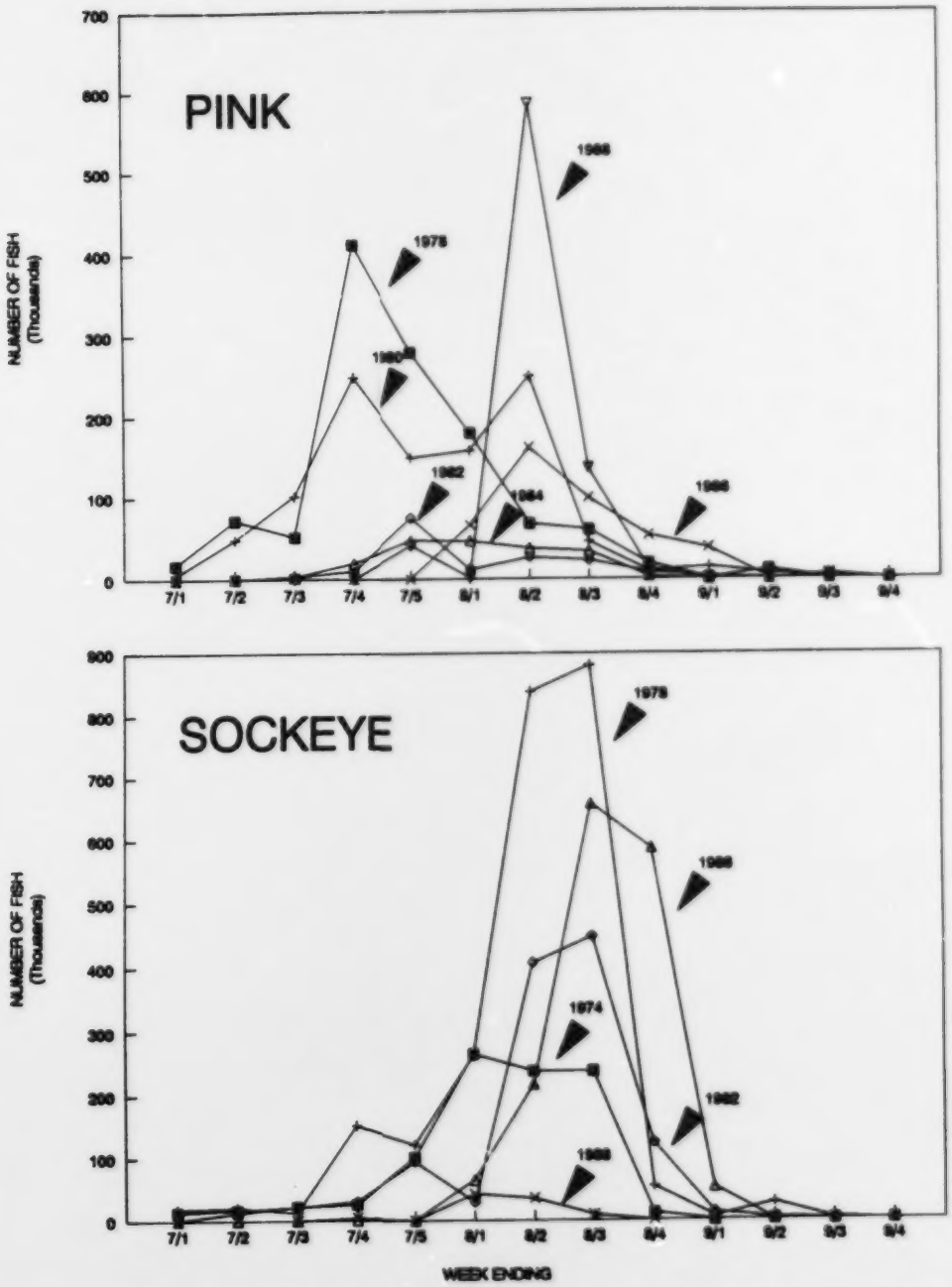

Figure 4. Weekly total catches of pink and sockeye salmon in Area 12 for 1978-1988 (even years).

(1980 and 1984). In 1988, major overlapping in arrival timing occurred between Chilko River sockeye and the abundant stocks arriving prior to and following the peak of this run. These included the Stellako, Birkenhead and Weaver Creek stocks which were substantially larger and earlier than forecast.

6.4.3 Sockeye Test Fishery

For the third consecutive year the D.F.O. and the P.S.C. jointly conducted a sockeye test fishery in Area 12 (Round Island) using a gillnet test vessel. Testing commenced on July 18th and ended on August 18th. Test catches provided continuous data on run strength while weekly scale sampling and analysis provided information on specific racial stock composition and diversion rates. Table 6 details the daily and mean weekly gillnet test catches and Figure 5 compares the weekly test and commercial catches.

6.4.4 Indian food fishery

The annual Indian pink and sockeye food fish catches in the Study Area for years 1970 - 1988 are presented in Table 7. The 1988 food fishery totalled 988 pink salmon and 10,960 sockeye. All food fish taken in the Study Area in 1988 came from Areas 12 and 13. Of the pink harvest the majority (79 %) were harvested in Area 12 while sockeye were harvested equally between Areas 12 and 13.

7.0 ESCAPEMENT

7.1 Study Area Pink Salmon

Study Area pink salmon escapements for the 1980-1988 cycle years are shown by stock in Figure 6 and Table 8, and by major streams in Appendix 2. Target escapements for each stream and sub-area are also included for comparison. A target escapement is defined as the highest production of an equal or greater escapement for even year stocks since 1950. During the management of the 1988 fishery, the target even year escapement of pinks to the Study Area was assessed at approximately 3.1 million.

The total Study Area escapement for 1988 was estimated at 1,830,500 pinks which is 59% of the estimated target escapement. The 1988 escapement was 1.3 times greater than the 1986 brood escapement and double the 1950-1988 cycle average escapement. The Bond to Knight sub-area which has been consistently the dominant contributor to the Study Area escapement since 1976 attributed

Table 6. Johnstone Strait Sockeye gillnet test fishery: daily catches, total effort and catch per unit effort (CPUE), 1988.

	DATE	SOCKEYE CATCH	EFFORT	CPUE
SUN	17-Jul-88			NA
MON	18-Jul-88			NA
TUE	19-Jul-88	47	82.7	0.57
WED	20-Jul-88	47	79.5	0.59
THU	21-Jul-88	58	81.6	0.71
FRI	22-Jul-88	48	81.2	0.59
SAT	23-Jul-88	32	83.0	0.39
	TOTAL 7/4	232	408	0.57
SUN	24-Jul-88			NA
MON	25-Jul-88			NA
TUE	26-Jul-88	44	78.2	0.56
WED	27-Jul-88	28	80.2	0.35
THU	28-Jul-88	66	88.5	0.75
FRI	29-Jul-88	56	78.0	0.72
SAT	30-Jul-88	143	78.7	1.82
	TOTAL 7/5	337	403.6	0.83
SUN	31-Jul-88	55	73.5	0.75
MON	01-Aug-88	67	84.4	0.79
TUE	02-Aug-88	50	82.5	0.61
WED	03-Aug-88	22	36.0	0.61
THU	04-Aug-88	29	86.7	0.33
FRI	05-Aug-88	20	90.8	0.22
SAT	06-Aug-88			NA
	TOTAL 8/1	121	296	0.41

	DATE	SOCKEYE CATCH	EFFORT	CPUE
SUN	07-Aug-88	10	88.9	0.11
MON	08-Aug-88			NA
TUE	09-Aug-88			NA
WED	10-Aug-88			NA
THU	11-Aug-88	21	98.5	0.21
FRI	12-Aug-88	20	100.9	0.20
SAT	13-Aug-88	53	101.7	0.52
	TOTAL 8/2	94	301.1	0.31
SUN	14-Aug-88			NA
MON	15-Aug-88			NA
TUE	16-Aug-88			NA
WED	17-Aug-88	12	98.1	0.12
THU	18-Aug-88	4	98.5	0.04
FRI	19-Aug-88			NA
SAT	20-Aug-88			NA
	TOTAL 8/3	16	196.6	0.08

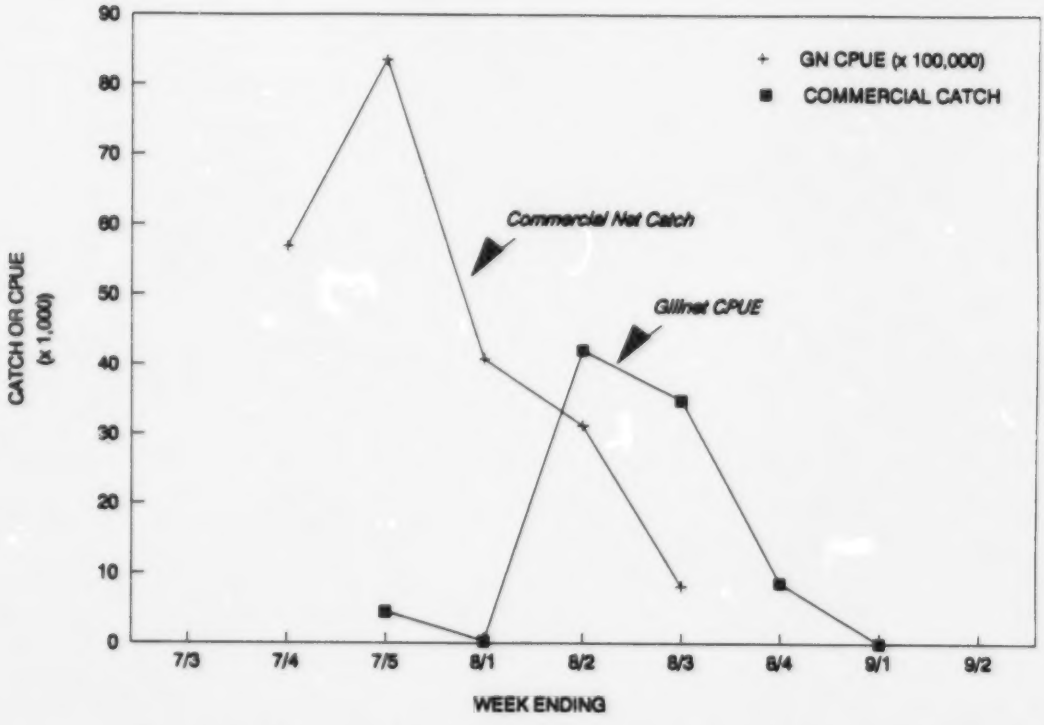

Figure 5. Comparison of weekly sockeye test fishing catches and commercial net catches in Area 12, 1988.

Table 7. Indian Food Fishery catches of pink and sockeye salmon by statistical area, 1970-1988.

PINK	STATISTICAL AREA									TOTAL
YEARS	12	13	14	15	16	17	18	19	20	INSIDE
88	783	205	0	0	0	0	0	0	0	988
87	4,125	129	0	50	819	0	0	0	400	5,523
86	650	333	0	0	0	0	0	0	0	983
85	3,347	1,908	0	0	0	0	0	0	0	5,255
84	1,000	2,463	0	0	N/A	0	0	0	0	3,463
83	3,392	10,192	0	0	5	0	0	0	0	13,589
82	73	1,419	0	0	15	0	0	0	0	1,507
81	2,270	900	3	0	3	0	0	0	0	3,176
80	N/A	315	0	0	0	0	0	0	0	315
79	5,000	598	0	N/A	15	0	0	0	0	5,613
78	2,000	140	N/A	N/A	0	0	0	0	0	2,140
77	350	1,143	N/A	0	186	50	0	0	0	1,729
76	1,700	92	0	0	0	0	0	0	0	1,792
75	500	2,313	0	0	0	0	0	0	250	3,063
74	350	215	0	0	0	0	0	0	0	565
73	1,271	951	0	0	0	0	0	0	0	2,222
72	1,912	52	0	5	0	0	0	0	0	1,969
71	549	455	0	0	28	0	0	0	0	1,032
70	94	21	0	0	0	0	0	0	0	115
AVG.	1,546	1,255	0	3	56	3	0	0	34	2,897

SOCKEYE	STATISTICAL AREA									TOTAL
YEARS	12	13	14	15	16	17	18	19	20	INSIDE
88	4,499	4,461	0	0	0	0	0	0	2,000	10,960
87	15,136	20,930	0	0	1,507	0	0	0	1,430	39,003
86	9,239	9,325	42	25	700	0	0	0	700	20,031
85	18,741	4,275	205	0	250	0	205	0	0	23,676
84	14,627	5,000	0	0	N/A	0	0	0	0	19,627
83	13,714	4,948	0	0	91	0	0	0	0	18,753
82	14,892	8,238	0	0	259	0	0	0	0	23,389
81	11,165	4,736	0	0	313	0	0	0	0	16,214
80	N/A	10,418	0	0	20	0	0	0	0	10,438
79	9,100	4,224	0	N/A	121	0	0	0	380	13,825
78	10,650	4,866	N/A	N/A	548	10	0	0	0	16,074
77	9,340	2,339	N/A	0	89	50	0	0	0	11,818
76	4,550	1,527	0	0	27	0	0	0	300	6,404
75	7,925	1,995	N/A	0	60	0	0	0	0	9,980
74	8,897	708	0	0	50	0	0	0	0	9,655
73	5,802	208	0	0	0	0	0	0	0	6,010
72	6,920	670	0	0	0	0	0	0	22	7,612
71	7,202	869	0	0	8	0	0	0	0	8,079
70	5,207	123	0	0	0	0	9	0	150	5,489
AVG.	9,348	4,729	13	1	213	3	11	0	262	14,581

n/a = not available, n/f = no fishery, uk = unknown

SOURCES:

1985-1986,1987 and 1988 "Annual Pacific Indian Food Fishery Catch Statistics"

1970-1984, (Bijsterveld, L. and M. James.1986 "Indian Food Fishery In the Pacific region: salmon catches, 1951 to 1984")

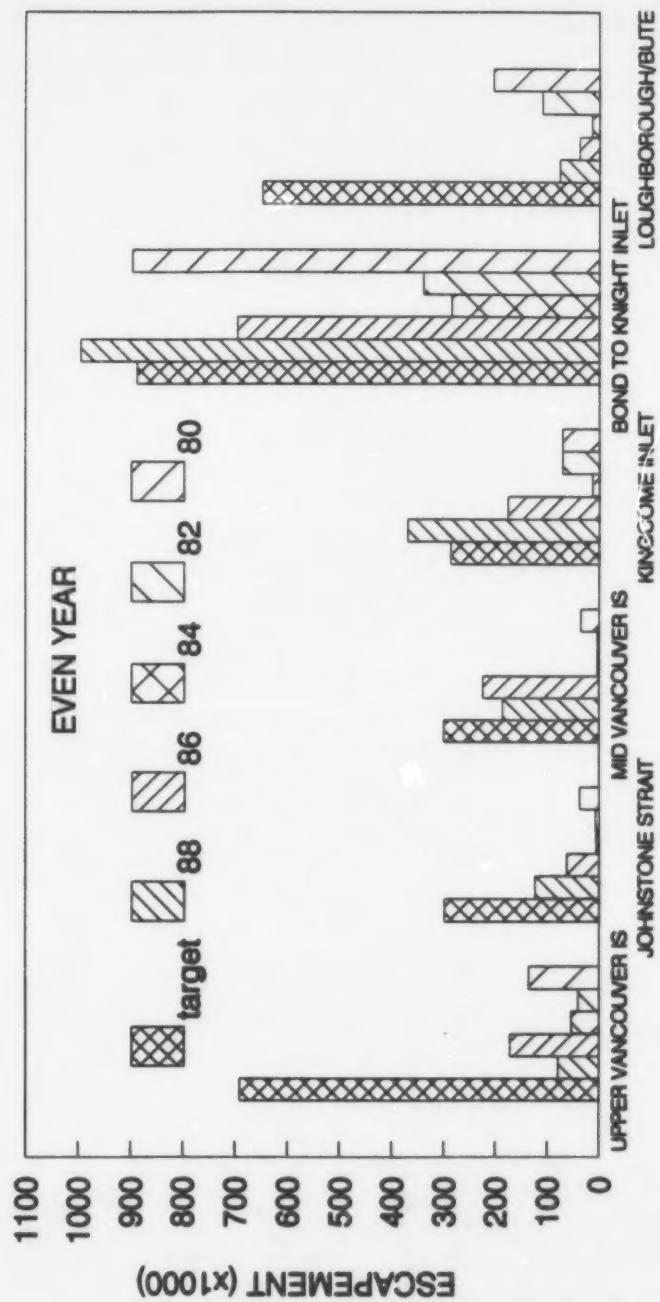

Figure 6. Pink salmon escapements by sub area in the Johnstone Strait Study Area, 1980-1988 cycle years (target escapments included).

Table 8. Wild Pink salmon escapements (in thousands) by sub-area to the Johnstone Strait Study Area.

SUB AREA TOTALS	TARGET ESCAPEMENT	1988	1986	1984	1982	1980	1978	1976	1974	1972	1970
UPPER VANCOUVER IS	690.0	79.2	172.1	54.0	41.2	136.0	114.7	237.2	181.3	124.7	458.7
JOHNSTONE STRAIT	299.0	123.4	62.9	6.5	6.9	38.1	79.0	129.3	211.6	172.1	129.8
MID VANCOUVER IS	300.0	186.3	223.6	4.2	3.7	35.6	19.4	45.3	23.5	20.7	17.2
KINGCOME INLET	287.0	369.4	175.8	13.2	72.2	72.0	62.7	347.9	342.9	251.7	204.4
BOND TO KNIGHT	888.0	994.7	695.3	286.0	339.7	896.4	634.1	758.6	169.4	54.6	234.3
LOUGHBOROUGH/BUTE	647.0	77.5	39.0	14.3	110.0	204.4	138.6	170.3	195.6	90.8	109.4
GRAND TOTAL	3111.0	1830.5	1368.7	378.2	573.7	1382.6	1048.4	1688.5	1124.2	714.6	1153.8

54.3% of the total 1988 Study Area escapement. The Kakweiken, Glendale and Ahnuhati rivers were the major producers. (Appendix 2). Kingcome Inlet sub-area was the second largest contributor in 1988, with a total escapement of 369,400 or 20.2% of the total. The Embly, Wakeman and Kingcome rivers all had returns equal to or surpassing their respective target escapements. The Mid-Vancouver Island escapement contribution totalled 186,300 pinks (10.2%), the majority originating from D.F.O. enhancement, namely the Quinsam hatchery and the Oyster River project. The remaining three sub-areas and lowest escapement contributors were Johnstone Strait, Loughborough to Bute and Upper Johnstone Strait whose returns totalled 123,400, 77,500 and 79,200 respectively. (see below).

1988 Pink escapements by sub-area

Sub-area	Target Esc.	Escapement	% of Study Area Total
Bond to Knight	888,000	994,700	54.4 %
Mid-Vancouver Island	300,000	186,300	10.2 %
Kingcome Inlet	287,000	369,400	20.2 %
Upper Vancouver Island	690,000	79,200	4.3 %
Johnstone Strait	299,000	123,400	6.7 %
Loughborough to Bute	647,000	77,500	4.2 %
Total	3,111,000	1,830,500	100.0 %

Overall, the total 1988 Study Area pink escapement, although significantly less than the desired target level of 3,111,000, was substantially greater compared to past cycle years dating back to 1970 (Table 8).

7.2 Study Area Sockeye

The five major sockeye systems located within the Study Area are the Nimpkish, Fulmore, Heydon, Phillips and Sakinaw rivers. Annual escapements by river are shown for the period 1972 - 1988 in Table 9. The total escapement for 1988 was 147,800. The Nimpkish River system, the major sockeye producer in the Study Area contributed 94.9% (140,000) of the total Study Area escapement in 1988. Total sockeye escapements to the Study Area have declined from an average of about 102,000 in the 1950s and 1960s to about 72,000 in the 1980s.

Table 9. Sockeye salmon escapements (in thousands) to streams in the Johnstone Strait Study Area, 1972- 1988.

Year	Nimpkish	Fulmore	Heydon	Phillips	Sakinaw	Total
1972	60.0	3.5	7.5	0.7	5.0	66.7
1973	100.0	10.0	3.5	3.5	1.5	118.5
1974	150.0	7.0	3.5	2.5	6.0	169.0
1975	40.0	6.0	3.5	1.5	16.0	67.0
1976	35.0	5.0	3.5	3.5	6.0	53.0
1977	15.0	1.5	3.5	1.5	1.2	22.7
1978	8.5	0.1	3.0	1.5	4.0	17.1
1979	20.0	0.5	2.0	1.5	11.0	35.0
1980	24.0	0.1	2.0	2.5	2.8	31.4
1981	60.0	0.8	4.5	5.0	3.0	73.3
1982	60.0	1.0	1.0	10.0	3.4	75.9
1983	70.0	1.5	NO	10.0	1.6	83.1
1984	50.5	NO	1.0	1.5	1.1	54.1
1985	75.0	1.0	NO	7.1	2.3	85.4
1986	40.0	UK	2.5	5.5	5.4	53.4
1987	125.0	UK	NO	7.0	4.2	136.2
1988	140.0	UK	UK	5.1	2.5	147.8
AVERAGES						
72-81	51.3	3.5	3.7	2.4	5.7	65.4
82-88	71.4	0.5	0.6	6.6	2.9	90.8

Abbreviations used: NO - none observed
UK - unknown

8.0 POST SEASON REVIEW

8.1 Johnstone Strait - Strait of Georgia Fishery

The Johnstone Strait commercial net fishery targeting on Fraser sockeye opened as scheduled on July 24 and closed August 22, 1988.

During the four week fishery, Areas 12 and 13 were opened for a total of 6.5 gillnet days and 6.0 seine days. Gillnets only in Area 11 and nets in Area 16 opened on August 7 for two consecutive weeks and closed with a seasonal total of 4.0 gillnet and 3.0 net days respectively. Extensions included 4.0 gillnet and 4.0 seine days over the pre-season plans. All extensions include a pre-week decision to extend by one day during the week 8/2 fishery (Table 2). Even though the expected stock abundance was higher, the main factor in reducing the number of fishing days as compared to previous years was the late start of the 1986 fishing season.

8.2 Study Area Pink

Preliminary estimate of the Study Area pink stock was 1,246,000, compared to the pre-season forecast of 1,022,000. The higher than expected pink return can be attributed largely to enhancement production, especially from the Quinsam River Hatchery in the lower Area 13 and Mid-Vancouver Island district. Monitoring of mainland inlets during the fishery resulted in no harvestable surplus being identified. The total Study Area pink catch of just under 0.6 million represented a bi-catch from a fishery targeting on Fraser sockeye. The peak migration based on incidental catches in the Study Area occurred during the second week of August. The bulk of the catch (74.0%) was taken in Area 12 with seines harvesting the majority (67.1%) of the Study Area catch.(Table 10)

8.3 Study Area Sockeye

The exploitation of Nimpkish sockeye stocks augment the Area 12 sockeye catch from mid-June through early August. In 1988, an estimated catch of 3,900 from an assessed return of 151,700 effected an exploitation rate of 2.6 %. The combined sockeye escapement to the Study Area totalled 147,800 and was the highest since 1974. The 2nd highest escapement since 1974 occurred in 1987 (Table 9).

8.4 Other Salmon Species

The incidental combined net catch of chinook in Johnstone Strait (Areas 11, 12 and 13) during the 1988 season totalled 6,250 pieces. This catch was less than half the 1987 catch of 13,813 and was only 22% of the 1981-1985 average catch of 28,590 (Table 11). This marked reduction in the 1988 catch can be attributed mainly to reduced fishing time and specific area restrictions.

During the pink and sockeye fisheries the catch of coho originating from Areas 11, 12, 13 and 16 totalled 53,720 pieces and in addition an incidental catch of 34,389 chum was also harvested.

Table 10. Catch, escapement, percent exploitation and ratio of return of the Johnstone Strait Study Area pink salmon, 1952-1988 (even years).

Year	Catch	Escapement	Total Stock	Percent Exploitation	Brood Escapement	Return to Escapement Ratio
1952	2,706,500	1,036,900	3,743,400	72.3%	662,320	5.7 : 1
1954	399,200	574,600	973,800	41.0%	1,036,900	0.9 : 1
1956	920,200	589,500	1,509,700	61.0%	574,600	2.6 : 1
1958	1,365,800	769,800	2,135,600	64.0%	589,500	3.6 : 1
1960	344,100	233,500	577,600	59.6%	769,800	0.8 : 1
1962	750,700	692,800	1,443,500	52.0%	233,500	6.2 : 1
1964	853,900	625,300	1,479,200	57.7%	692,800	2.1 : 1
1966	3,438,500	1,337,100	4,775,600	72.0%	625,300	7.6 : 1
1968	3,695,700	1,476,900	5,172,600	71.4%	1,337,100	3.9 : 1
1970	2,341,100	1,153,800	3,494,900	67.0%	1,476,900	2.4 : 1
1972	729,600	714,600	1,444,200	50.5%	1,153,800	1.3 : 1
1974	1,548,600	1,124,200	2,672,800	57.9%	714,600	3.7 : 1
1976	3,777,600	1,688,500	5,466,100	69.1%	1,124,200	4.9 : 1
1978	1,347,400	1,048,400	2,395,800	56.2%	1,688,500	1.4 : 1
1980	1,192,800	1,382,600	2,575,400	46.3%	1,048,400	2.5 : 1
1982	194,500	573,700	768,200	25.3%	1,382,600	0.6 : 1
1984	232,000	378,200	610,200	38.0%	573,700	1.1 : 1
1986	574,500	1,368,700	1,943,200	29.6%	378,200	5.1 : 1
1988	989,200	1,830,500	2,819,700	35.1%	1,368,700	2.1 : 1
AVERAGE						
52-88	1,442,200	978,900	2,421,100	54.0%	917,400	3.1 : 1
76-88	1,186,900	1,181,500	2,368,400	42.8%	1,080,600	2.5 : 1
80-88	636,600	1,106,700	1,743,300	34.9%	950,300	2.3 : 1

Source: British Columbia Catch Statistics, DFO. Areas 11-16 all gear.
Source: DFO Escapement Files.
Mean of annual percent exploitation values.
Mean of annual ratios.

Table 11. Annual net catches of chinook in combined Areas 11, 12 and 13 , 1979-1988.

	GN		SN		Total		Total Adult		
Year	Adult	Jack	Adult	Jack	Adult	Jack	GN	SN	Total
1979	5278	319	25891	11895	31169	12214	5278	25891	31169
1980	4885	960	24698	11950	29583	12910	4885	25698	29583
1981	4371	506	24249	13069	28620	13575	4371	24249	28620
1982	6487	600	23092	9649	29579	10249	6487	23092	29579
1983	3772	1059	24574	22260	28346	23319	3772	24574	28346
1984	4043	1120	14315	12820	18358	13940	4043	14315	18358
1985	5287	879	32759	4398	38046	5277	5287	32759	38046
1986	4927	793	12921	3327	17848	4120	4927	12921	17848
1987	3078	1425	10735	3020	13813	4444	3078	10735	13813
1988	1307	259	4943	3883	6250	4142	1307	4943	6250
Average									
81-85	4792	833	23798	12439	28790	6636	4792	23798	28590

Source: British Columbia catch statistics, D.F.O.
All catches are for the year up to and including week ending 11-1.

9.0 ACKNOWLEDGEMENTS

The authors extend thanks to all district and sub-district staff for the cooperative effort during the 1988 Johnstone Strait Study Area fisheries and to Louise Naylor and Tracy Cone for preparing graphs and tables.

Appendix 1. Weekly net fishing season: pre-season plans, in-season management and rationale, Areas 11-13 and 16, 1988.

Date	Area and Sub-Area	Pre-season fishing plan: Days Fishing GN	SN	Rationale for pre-season plans	In-season management: Days Fishing GN	SN	Changes from pre-season	Rationale for alteration of pre-season plans
Jul 24 - 30 (Wk 7/5)	11	-	-	Total Nimpkish River and Fraser River sockeye abundance 150,000 and 2,900,000 respectively. Nimpkish River sockeye abundance dictates upper Area 12 closure. Anticipate surplus Fraser River sockeye for early timed and modest Chilko River harvest.	Not extended Days fishing as per pre-season.		No changes	
	12 (1,3 & 4)	1.5	1.0					
	13 (7-9, 28-32)	1.5	1.0					
	16	Closed			Closed			
July 21 - Aug 6 (Wk 8/1)	11	Closed		Closed to maintain low Chilko River sockeye harvest rate and achieve escapement.	Not extended Days fishing as per pre-season		No changes	
	12	Closed						
	13	Closed						
	16	Closed						
Aug 7 - 13 (Wk 8/2)	11 (1, 2 portion)	2.5	-	Open to harvest surplus late run Chilko and Stellako.	1.5+1	-	Delayed opening due to low abundance indicated by Area 20 test fishing and to protect remaining Chilko River sockeye for escapement.	Limited catches and low effort during the first 24 hours in Johnstone Strait and Sabine Channel precipitated extension.
	12 (1, 3-5, 8-11, 12 portion)	2.5	2.0		1.5+1	1+1		
	13 (7-9, 28-32)	2.5	2.0		1.5+1	1+1		
	16 (21)	2.0	2.0		1.0	1.0		
					One day extension from pre-season plan			

(contd.)

Appendix 1 (contd.)

Date	Pre-season fishing plan: Area and Sub-Area	Days Fishing GN	Days Fishing SN	Rationale for pre-season plans	In-season management: Days Fishing GN	Days Fishing SN	Changes from pre-season	Rationale for alteration of pre-season plans
Aug 14 - 20 (Wk 8/3)	11 (1, 2 portion)	2.5	-	Open for harvest of Weaver Creek and other late run sockeye.	Not extended Days fishing as per pre-season.		No changes.	
	12 (1, 3-5, 8-11, 12 portion)	2.5	2.0					
	13 (7-9, 28-32)	2.5	2.0					
	16 (21)	2.5	2.0					
Aug 21 - 27 (Wk 8/4)	11 (1, 2 portion)	2.5	-	Open for harvest of Weaver Creek and other late run sockeye.	Not extended 0	-	Closed to gillnets in all Areas. Seine fishing reduced by 1 day in Areas 12 and 13. Area 16 closed.	Gillnets have attained catch allocation. Fishing reduced as T.A.C. achieved. Area 16 seines closed due to low expected catches and chinook bi-catch.
	12 (1-6, 8-10, 12, 18)	2.5	2.0		0	1.0		
	13 (7-9, 28-32)	2.5	2.0		0	1.0		
	16 (21)	2.0	2.0		0	0		

Appendix 2. Pink escapement (in thousands) to streams and sub-areas in the Johnstone Strait Study Area, 1970-1988 (even years).

SUB AREA & RIVER	OPTIMUM	1988	1986	1984	1982	1980	1978	1976	1974	1972	1970
UPPER VANCOUVER IS											
CLUXEWE R.	100.0	15.0	35	15.0	10.0	80.0	0.0	49.0	32.0	6.0	35.0
KEOGH R.	100.0	50.0	100.0	25.0	30.0	35.0	48.0	72.0	55.0	50.0	125.0
NAHWITTI R.	75.0	1.0	0.4	0.0	UN	UN	0.4	0.2	11.0	22.0	110.0
QUATSE R.	100.0	12.0	35	13.0	0.5	10.0	36.0	74.0	66.0	16.0	75.0
SHUSHARTIE R.	200.0	0.1	0.2	N/O	0.2	3.0	-	0.1	0.3	0.4	3.5
SONGHEES R.	5.0	U/K	N/O	N/O	0.3	-	2.3	3.5	3.0	1.8	0.2
STRANBY R.	75.0	0.1	UN	UN	UN	3.5	-	1.5	3.0	24.0	75.0
TSULQUATE R.	35.0	1.1	1.5	1.0	0.2	4.5	28.0	37.0	11.0	4.5	35.0
MISC.	-	-	-	-	-	-	-	-	-	-	-
TOTAL	690.0	79.2	172.1	54.0	41.2	136.0	114.7	237.2	181.3	124.7	458.7
JOHNSTONE STRAIT											
ADAM R.	70.0	55.0	35.0	4.0	4.8	20.0	50.0	55.0	60.0	50.0	15.0
BEAR R.	100.0	14.0	17.0	2.0	0.5	5.7	18.0	52.5	130.0	100.0	100.0
HYDE CR.	5.0	0.3	0.0	N/O	UN	0.3	UN	0.1	0.1	0.1	0.4
KOKISH R.	10.0	0.2	1.5	N/O	UN	N/O	N/O	UN	0.3	0.4	1.5
MENZIES R.	4.0	1.8	0.0	N/O	UN	0.1	-	0.2	0.4	0.4	0.8
MILLS CR.	10.0	3.5	0.2	N/O	UN	-	0.4	1.8	UK	0.4	0.8
MOHUN CR.	4.0	14.0	N/O	N/O	N/O	-	-	-	0.0	0.4	3.5
NIMPKISH R.	50.0	4.5	0.2	UN	1.5	7.5	1.7	0.4	12.0	12.0	4.0
SALMON R.	35.0	30.0	7.5	0.5	0.1	2.0	8.0	15.0	3.5	7.5	3.5
TSITIKA R.	10.0	0.1	1.5	0.0	N/O	0.6	0.8	4.0	5.0	0.8	0.0
MISC.	1.0	0.1	0.0	-	0.1	2.0	0.1	0.3	0.3	0.2	0.4
TOTAL	299.0	123.4	62.9	6.5	6.9	38.1	79.0	129.3	211.6	172.1	129.8
MID VANCOUVER IS											
CAMPBELL R.	30.0	5.7	10.0	0.5	0.5	1.5	1.1	10.0	4.0	3.5	3.5
ENGLISHMAN R.	0.0	U/K	N/O	N/O	0.0	0.1	0.0	0.0	0.0	0.0	0.1
OYSTER R.	35.0	25.0	0.1	0.0	0.2	5.0	0.4	0.9	0.9	1.1	1.6
PUNTLEDGE R.	15.0	6.3	0	0.1	0.7	6.2	1.6	0.4	0.9	2.5	1.0
QUINSAM R.	120.0	147.4	213.4	3.6	2.1	17.4	14.8	24.0	7.5	3.5	1.5
Quinsam hatchery	20.0	23.2	18.6	9.3	4.8	3.8	0.3				
TSOLUM R.	100.0	2.0	0	0.0	0.2	5.0	1.5	10.0	10.1	10.0	6.9
MISC.	-	0.0	0.1	-	0.0	0.4	0.0	0.1	0.1	0.1	2.6
TOTAL	300.0	186.3	223.6	4.2	3.7	35.6	19.4	45.3	23.5	20.7	17.2
hatchery not included in totals											
KINGCOME INLET											
CARRIDEN CR.	2.0	7.0	0.5	N/O	N/O	1.0	1.5	0.6	0.6	0.8	3.5
EMBLY R.	100.0	145.0	120.0	7.0	12.0	25.0	13.0	7.0	70.0	100.0	100.0
KINGCOME R.	100.0	92.0	31.0	2.2	24.0	20.0	20.0	280.0	190.0	75.0	25.0
WAKEMAN R.	80.0	125.0	24.0	4.0	35.0	25.0	25.0	55.0	81.0	75.0	75.0
MISC.	5.0	0.4	0.3	-	1.2	1.0	3.2	5.3	1.3	1.0	0.9
TOTAL	287.0	369.4	175.8	13.2	72.2	72.0	62.7	347.9	342.9	251.7	204.4

Appendix 2 - cont'd.

SUB AREA & RIVER	OPTIMUM	1988	1986	1984	1982	1980	1978	1976	1974	1972	1970
BOND TO KNIGHT											
AHNUHATI R.	125.0	225.0	150.0	50.0	85.0	340.0	120.0	100.0	15.0	3.0	35.0
AHTA VALLEY CR.	20.0	N/O	0.0	N/O	N/O	0.1	1.3	0.3	-	3.5	1.5
GILFORD(FRASER C.)	0.0	-	0.0	0.0	0.2	UN	UN	UN	0.0	0.0	-
GLENDALE R.	200.0	254.3	240.0	125.0	150.0	250.0	275.0	150.0	30.0	9.5	150.0
Glendale channels	32	45.7									
HOEYA CR.	10.0	8.0	1.5	0.4	3.5	0.8	2.0	6.0	2.0	0.8	0.4
KAKWEIKEN R.	500.0	475.0	250.0	100.0	70.0	300.0	222.0	500.0	100.0	15.0	35.0
KAMANO BAY CR.	2.0	U/K	0.0	0.0	0.0	0.1	0.1	0.1	0.5	1.0	3.5
KLINAKLINI R.	0.0	U/K	UN	UN	UN	UN	NO	0.3	0.1	0.8	0.8
KWALATE R.	5.0	1.7	1.1	0.2	0.2	0.1	N/O	0.1	UN	UN	UN
LULL CR.	4.0	7.1	0.5	0.5	0.7	0.6	0.2	1.5	1.5	0.4	0.4
NIGGER CR.	0.0	3.5	25								
VINER R.	2.0		0.0	UN	0.1	0.4	-	0.0	0.2	0.4	4.0
WATERFALL CR.	20.0	12.0	24.0	10.0	30.0	3.5	13.0	0.3	20.0	20.0	3.5
MISC.	0.0	8.2	3.2	-	0.1	1.0	0.6	0.1	0.1	0.2	0.3
TOTAL	888.0	994.7	695.3	286.0	339.7	896.4	634.1	758.6	169.4	54.6	234.3
LOUGHBOROUGH TO BUTE											
APPLE R.	60.0	U/K	0.1	N/O	N/O	2.0	3.5	4.0	-	1.5	5.0
CAMELEON HBR. CR.	10.0	0.1	1.5	0.3	1.5	8.0	2.5	1.5	5.0	3.5	7.5
CUMSACK CR.	0.0	0.0	UN	N/A	UN	N/O	-	-	-	-	-
EVA CR.	5.0	-	UN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FANNY BAY CR.	0.0	0.1	UN	N/O	N/O	-	-	-	-	0.0	1.5
FRASER CR.	20.0	0.1	0.3	N/O	UN	0.3	0.5	1.5	1.5	0.4	3.5
FULMORE R.	0.0	U/K	0.0	N/O	N/O	UN	UN	UN	UN	UN	UN
GRANITE CR.	10.0	N/O	0.0	0.0	N/O	UN	N/O	-	-	0.4	1.5
GRASSY CR.	150.0	3.8	4.0	1.0	40.0	40.0	100.0	75.0	100.0	25.0	25.0
GRAYS CR.	10.0	3.5	1.0	0.3	1.0	0.6	1.8	0.8	7.5	0.8	3.5
HEYDON CR.	30.0	4.0	1.5	0.2	1.5	2.5	1.0	15.0	10.0	3.5	15.0
HOMATHKO R.	10.0	N/O	0.0	N/O	N/O	N/O	-	-	-	0.8	1.5
HYACINTHE CR.		U/K	0.0	N/O	UN	NO	-	-	-	-	0.2
KANISH CR.	7.0	-	0.0	N/O	N/O	N/O	-	-	0.1	3.5	4.0
ORFORD R.	35.0	N/O	N/O	N/O	N/O	N/O	0.1	-	-	-	0.2
PHILLIPS R.	175.0	45.0	12.0	2.0	2.5	30.0	10.0	50.0	35.0	35.0	15.0
READ CR.	20.0	7.0	1.5	2.5	3.5	45.0	3.5	12.0	20.0	7.5	7.5
STAFFORD R.	20.0	U/K	2.0	UK	N/O	1.0	0.8	1.5	3.5	1.5	3.5
SOUTHGATE R.	10.0	N/O	N/O	N/O	N/O	N/O	-	-	-	-	-
WORTLEY CR.	75.0	14.0	15.0	8.0	60.0	75.0	15.0	9.0	13.0	7.5	15.0
MISC.	-	0.0	0.1	-	-	-	-	-	-	-	-
TOTAL	647.0	77.5	39.0	14.3	110.0	204.4	138.6	170.3	195.6	90.8	109.4
GRAND TOTAL	3111.0	1830.5	1368.7	378.2	573.7	1382.6	1048.4	1688.5	1124.2	714.6	1153.8

Mohun 1988 13k transplant from Quinsam
NOTE : N/O = NONE OBSERVED; UN = UNKNOWN
Quinsam River and hatchery data 1978 onward from hatchery
Quinsam hatchery totals may include experiment fish to PBS